

NAME: Key

Probability Rules Review- 3

1. If  $P(A) = 0.68$  and  $P(B) = 0.13$  and  $P(A \cap B) = 0.07$ , find the following:

a.  $P(A \cup B) = P(A) + P(B) - P(A \cap B) = 0.74$

b.  $P(B|A) = \frac{P(A \cap B)}{P(A)} = 0.1029$

- c. Are A and B disjoint events? Why or why not?

No,  $P(A \cap B) \neq 0$ .

- d. Are A and B independent? Why or why not?

No.  $P(B|A) \neq P(B)$

2. If  $P(D) = 0.25$ ,  $P(C) = 0.33$  and D and C are disjoint, what is the probability of D or C?

$$P(D \cup C) = P(D) + P(C) = 0.58$$

3. If  $P(K) = 0.60$ ,  $P(R) = 0.30$  and K and R are independent, what is the probability of K and R?

$$P(K \cap R) = P(K) \cdot P(R) = 0.18$$

4. If  $P(F) = 0.45$  and  $P(H) = 0.21$  and  $P(H|F) = 0.14$ , find the following:

a.  $P(F \text{ and } H) = P(F) \cdot P(H|F) = 0.063$

b.  $P(F \cup H) = P(F) + P(H) - P(F \cap H) = 0.597$

- c. What is the complement of F?

$$P(F^c) = 0.55$$

- d. What is the complement of H?

$$P(H^c) = 0.79$$

5. Let the sample space,  $S = \{\text{all whole number from 10 through 30}\}$   
 Let the event  $A = \{10, 15, 20, 25, 30\}$   
 Let the event  $B = \{10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30\}$   
 Let the event  $C = \{11, 13, 15, 17, 19, 21, 23, 25, 27, 29\}$

Find the following:

- a.  $A \cap B = \{10, 20, 30\}$
- b.  $P(A \cap B) = \frac{3}{21}$
- c.  $C^c = \{10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30\}$
- d.  $P(A \cap C) = \frac{2}{21}$
- e.  $P(B \cap C) = \frac{0}{21} = 0$
- f.  $P(B^c) = \frac{10}{21}$
- g.  $C \cup B = \{10, 11, 12, \dots, 28, 29, 30\}$

For the next question, put the probability statements into notation to help you.

6. On a certain day, there is a 41% chance for snow. The probability of Sue remembering to bring her scarf & gloves to work **and** it snowing is 30%. What is the probability that ~~it snows given that~~ Sue remembering to bring her scarf & gloves to work **given that** it snows?

$$P(S_n) = 0.41$$

$$P(S_c \cap S_n) = 0.30$$

$$P(S_c | S_n) = \frac{P(S_c \cap S_n)}{P(S_n)} = 0.732$$

7. Out of 50 students in an organization, how many ways can we choose a executive committee of 5 students?

$$50nC_r 5 = 2,118,760$$

8. There are 60 people that have entered a raffle drawing. There are 3 prizes being given out (\$1000, \$500, \$10). How many different ways can this be done?

$$60 \text{ nPr } 3 = 205,320$$

9. Titan Council has 100 members in it. We want to create an executive board, made up of officers and a council. **First** we choose a President, VP, Secretary and Treasurer. After these have been chosen, we choose the council of 10 people. How many ways can this be done?

$$(100 \text{ nPr } 4) \cdot (96 \text{ nCr } 10) = 1.06 \times 10^8$$

10. For the lottery, there are 50,000 people that play. There is 1 grand prize of \$30,000, 15 second place prizes \$1000, 25 third places prizes of \$250 and 30 fourth place prizes of \$50. It costs \$3 to play the lottery.

- a. Create a probability model for the **GAIN** for each player

X	29,997	997	247	47	-3
P(X)	$\frac{1}{50,000}$	$\frac{15}{50,000}$	$\frac{25}{50,000}$	$\frac{30}{50,000}$	$\frac{49,929}{50,000}$

- b. What is the expected gain for each player?

$$E(X) = \mu_X = -1.945$$

- c. If a player plays the lottery 50 times, what is their **expected** total gain?

$$-1.945 \times 50 = -97.25$$

$$P(\text{HW}) = 0.65 \quad n=4$$

11. Suppose that in a math class, 65% of the students do their HW on a nightly basis.

- a. Create the probability model for X, the number of students who do their HW out of a sample of 4 students.

X	P(X)
0	$(4nC0)(0.65)^0(0.35)^4 = 0.015$
1	$(4nC1)(0.65)^1(0.35)^3 = 0.1115$
2	$= 0.3105$
3	$= 0.3845$
4	$= 0.1785$

- b. What is the probability that there will be exactly 3 students that did their HW last night?

$$P(X=3) = 0.3845$$

- c. What is the probability that at least 2 students did their HW last night?

$$P(X \geq 2) = 0.8735$$

- d. What is the probability that less than 2 students did their HW last night?

$$P(X < 2) = 0.1265$$

- e. What is the probability that no one did their HW last night?

$$P(X=0) = 0.015$$

- f. What is the probability that everyone did their HW last night?

$$P(X=4) = 0.1785$$

12. Random variable B has mean of 4.2 and std. dev. of 2.1. Random variable K has mean of 25.3 and std. dev. of 6.3. Find the following:

a.  $\mu_{B-K} = \mu_B - \mu_K = -21.1$

b.  $\sigma_{2B-K} \Rightarrow \sigma_{2B-K}^2 = \sigma_{2B}^2 + \sigma_K^2 = 2^2(2.1)^2 + (6.3)^2 = 57.33 = 7.57$

c.  $\mu_{4B-5K-3}$

$$= 4 \cdot \mu_B - 5 \cdot \mu_K - 3 = 4 \cdot 4.2 - 5 \cdot 25.3 - 3 = -112.7$$

d.  $\sigma_{2/3B+4K+10}$

$$\begin{aligned} \sigma_{2/3B+4K}^2 &= \sigma_{2/3B}^2 + \sigma_{4K}^2 = 2/3^2(2.1)^2 + 4^2(6.3)^2 \\ &= \sqrt{637} = 25.239 \end{aligned}$$

$$\mu_B = 4.2$$

$$\sigma_B = 2.1$$

$$\mu_K = 25.3$$

$$\sigma_K = 6.3$$